federal register

Tuesday
October 7, 1980

Part IX

Environmental Protection Agency

Ozone-Depleting Chlorofluorocarbons; Proposed Production Restriction

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 762

[OPTS-62009 (TSH-FRL 1606-5)]

Ozone-Depleting Chlorofluorocarbons; Proposed Production Restriction

AGENCY: Environmental Protection Agency (EPA).

ACTION: Advance notice of proposed rulemaking.

SUMMARY: Because of the destructive effect of chlorofluorocarbons (CFCs) on stratospheric ozone, EPA is considering restricting their production such that the potential for ozone depletion does not increase over present levels. Two major approaches to CFC emissions control are being considered: a Mandatory Controls Approach and an Economic Incentives Approach. The first would limit CFC production through mandatory controls or technology based standards. The second would limit CFC production through the distribution of marketable permits. Several options are being explored for the implementation of these strategies.

EPA solicits comments on the appropriateness of restricting the use of CFCs and on the feasibility of implementing the Mandatory Controls and Economic Incentives Approaches.

DATES: Written comments on or before January 5, 1981.

ADDRESS: Written comments should be sent to the Technical Information Specialist for this Advance Notice of Proposed Rulemaking: Joni T. Repasch, Office of Pesticides and Toxic Substances (TS-793), Environmental Protection Agency, Room E-447, 401 M St., SW, Washington, D.C. 20460, (202-755-8050).

FOR FURTHER INFORMATION CONTACT: Gordon R. Olson, Office of Pesticides and Toxic Substances (TS-794), Environmental Protection Agency, 401 M St., SW, Washington, D.C. 20460, (202-755-1260).

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I. Ozone Depletion and the Need for Regulatory Control

A. Introduction

Chlorofluorocarbons (CFCs) are a family of chemical compounds suspected of depleting stratospheric ozone. When ozone concentration is reduced, increased amounts of damaging ultraviolet light (DUV) are permitted to reach the earth's surface. This may have a number of harmful consequences, including higher incidence of skin cancer, decreased crop yields for several important species and adverse effects on the marine food chain.

In March of 1978 the Environmental Protection Agency and the Food and Drug Administration banned CFCs as propellants in nonessential aerosol uses (ref. 1). Several other nations have also already acted to restrict aerosol propellant applications of CFCs. However, continued world emissions of CFCs are still considered a significant and increasing threat to human health and the environment. The temporary emissions reduction achieved by the actions of the United States and other nations regarding CFC aerosol propellants has been nearly eliminated by rapid growth of CFC usage in nonaerosol applications in the United States and abroad, and by continued aerosol use in nations which have as yet taken no control actions.

At present there are five domestic producers of CFCs. The overwhelming percentage of CFC emissions occur in use rather than in manufacturing—approximately 98 percent and 2 percent, respectively—so the regulations are directed at controlling emissions in the various CFC applications.

The major non-aerosol uses of CFCs in the United States are:

1. As a refrigerant in mobile air conditioning units used in passenger vehicles;

2. As a solvent, primarily in industrial cleaning, drying, and solder flux removal applications;

3. As the blowing agent for closed-cell rigid foams, used in insulating and packaging applications;

4. As the blowing agent for open-cell flexible foams, used in bedding, furniture, automobile seat cushions, and carpet underlay;

5. As the refrigerant for large industrial and commercial chillers, home refrigerators, freezers and air conditioners, and retail food store refrigerators; and

6. In numerous miscellaneous uses such as liquid fast-freezing of food and hospital instrument sterilization.

Use of CFCs worldwide is projected to increase substantially over the next decade. Production of CFCs in the United States is expected to grow at a 7 percent annual rate (in the absence of any further regulation), from 600 million pounds in 1980, to 1.2 billion pounds in 1990, according to the report on CFC control written for EPA by the RAND Corporation. (ref. 2) Total world emissions, in the absence of any further regulation, are projected to grow at a 9 percent annual rate over the next decade, from 1.5 billion pounds in 1980 to 4.5 billion pounds in 1990, according to EPA analysis of data collected for the Chemical Manufacturers Association. (ref. 3)

The objective of Agency action is to limit CFC use in all applications such that the potential for ozone depletion does not increase over present levels. The proposed action will recognize the differential impact that individual CFC compounds have on ozone depletion (see Permit Pound Concept, Section II.B.2.a., below).

EPA is considering two major approaches to CFC control. The first is a Mandatory Controls Approach. This would put an indirect ceiling on CFC use through mandatory controls or technology-based standards. Three options for implementing these controls are discussed in Section II B 1. The second major approach is an Economic Incentives Approach. This would put a ceiling on total production, and be implemented through a system in which marketable rights to CFCs are distributed. Three different options for allocating these rights are discussed in Section II B 2. Based upon presently available information, EPA believes the latter approach to be a more efficient method of reducing the environmental and human health risk. The merits of each approach are discussed in more detail later.

This regulatory action would constitute the first United States control on CFCs since the ban on nonessential aerosol propellant uses that was promulgated jointly by EPA and the Food and Drug Administration in March 1978. EPA solicits comments on the approaches, options and issues

presented in this advance notice of proposed rulemaking.

EPA Phase II CFC regulations will be promulgated under the authority of Section 157 of the Clean Air Act, as amended, (42 U.S.C. 7450–7459), unless EPA finds under Section 6(c)(1) and Section 9(b) of the Toxic Substances Control Act (TSCA) (15 U.S.C. 2601) that it is in the public interest to use TSCA instead of the Clean Air Act.

B. A Summary of the Ozone Depletion Theory

The ozone layer is located in the stratosphere, 10 to 50 kilometers above the earth's surface. It is important to the natural environment because it prevents the more damaging wavelengths (290–320 nm) of solar radiation—those not screened out by other atmospheric constituents—from reaching the earth.

The concentration of ozone present in the stratosphere is determined by a dynamic balance between naturally occuring photochemical reactions producing it and other chemical processes destroying it. The rate of destruction of ozone is influenced by the presence of several chemical species containing hydrogen, nitrogen, or chlorine.

In view of the vital screening function of the ozone layer, any significant increase in the rate at which chlorine species are injected into the stratosphere should be of concern, because chlorine and chlorine oxide act as catalysts in certain reactions that destroy ozone. Two University of California scientists theorized in 1974 that CFCs slowly migrate to the stratosphere where they are photolytically disassociated, releasing free chlorine. The continued worldwide release of CFCs is therefore troublesome, it appears to significantly increase the chlorine concentration in the stratosphere and this in turn leads to ozone depletion. EPA has relied primarily upon the scientific analysis of the National Academy of Sciences (NAS) for support of this theory as well as for an assessment of the potential hazards posed by continued world emissions of CFCs.

Global CFC emissions are not large compared to the emissions of other chlorine-containing chemical compounds, but these other compounds are for the most part quickly destroyed or otherwise removed in the troposphere so that only a small percentage of ground-level emissions reach the stratosphere. In contrast, CFCs are very resistant to removal in the troposphere, so that most of the CFCs emitted at ground level eventually reach the stratosphere where, in the presence of more intense and shorter-wavelength ultraviolet light, they are decomposed and release chlorine.

To better quantify the predicted effects of CFCs on ozone concentrations, several research groups around the world have undertaken computer simulations of the relevant atmospheric chemistry and physics. Because of the complexity involved in closely simulating such large-scale natural systems, simplifications have been introduced into these models. The most significant simplification has been to consider variations in the concentrations of chemical species only along the vertical dimension (altitude), assuming perfect mixing along the longitudinal and latitudinal dimensions. These are the so-called One-Dimensional Models (1–D Models).

The basic function of the 1–D Models is to solve a complex set of differential equations, providing vertical profiles of species concentrations at any moment in time. Included in the models are a large number of chemical reactions believed to be occurring in the atmosphere. The chemical reaction rate coefficients and the photolysis rate coefficients (measures of the speed with which reactions occur), the vertical diffusion coefficients (a measure of the speed of vertical transport), and other parameters needed to produce a numerical solution have generally been measured either in the field or in the laboratory. A few are estimates. The inputs to the models are based on both historical and predicted future annual emissions of CFCs at the earth's surface.

NAS used such a model to calculate future effects on the ozone concentration of various emissions scenarios for CFMs.[1] The four scenarios NAS considered all use the same historical emissions data, but differ in their predicted future emissions:

Scenario A assumes that future emissions would be fixed at 1977 levels;

Scenario B assumes that future emissions would remain at 1977 levels until 1983, when a reduction of 25 percent would occur, and that emissions after 1983 would remain fixed at that lower level;

Scenario C is identical to B, except that an additional 25 percent step reduction is assumed to occur in 1988—emissions after 1988 would then remain fixed at this new level;

Scenario D assumes that emissions would grow at 7 percent a year until 2000, and then remain constant.

For these four scenarios, NAS predicts the following percentages of ozone depletion:

Table 1.—*Predicted Percent Ozone Depletion* [1]

Scenario	In 20 years (1998)	In 50 years (2028)	Steady-state [2]
A	6.1– (±4.2)	10.0– (±7)	16.5– (±11.5)
B	5.6– (±3.9)	8.0– (±6)	13.3– (±9.3)
C	5.2– (±3.5)	6.0– (±4)	9.4– (±6.8)
D [3]	9.0	28.0	57.0

[1] CFMs only.
[2] The steady-state gives the limiting equilibrium value for ozone depletion, and is equivalent to base year + about 100 years (theoretically infinity).
[3] Error ranges are not provided for this scenario, nor are the average values for ozone depletion corrected for temperature and water-vapor feedbacks or tropospheric sinks.
Source: National Academy of Sciences.

NAS also estimated that historical emissions of CFMs may have already led to an ozone depletion of 2.1 (±1.5) percent.

C. The Risks of Continued World Chlorofluorocarbon Emissions

The National Academy of Sciences issued two sets of reports on this subject in 1976 and 1979. As shown above, the latest reports of the NAS, issued in November and December, 1979 (ref. 5, 6) conclude that continued world CFM emission at 1977 rates would eventually result in ozone depletion of about 16.5 percent (with a 95 percent probability that the eventual level would fall in the range from 5 to 28 percent depletion). One-fourth of this depletion would occur within 15 years, and one-half within 35 years. NAS also concludes that if emissions were to continue to increase between 1980 and 2000 by 7 percent annually, instead of leveling off at 1977 levels, there would be a 75 percent probability that ozone depletion would eventually exceed 30 percent (ref. 6, p. 99). Other studies report estimates of ozone depletion that differ somewhat from these in the NAS study, but that fall within the confidence interval of the NAS study.

Ozone depletion would substantially increase the average intensity of biologically damaging ultraviolet light (DUV) reaching the earth's surface. This increase could be as high as 44 percent at mid-latitudes for an ozone depletion of 16 percent. Such increases would be highly detrimental both to human health and to nonhuman biological systems.

Assuming continuation of present patterns of sunlight exposure, NAS predicts that a 16 percent ozone depletion would result in several

[1] CFMs, or Chlorofluoromethanes, are a group of chemicals within the CFC family, which NAS considered because two of them, trichlorofluoromethane (CFC–11) and dichlorodifluoromethane (CFC–12), make up greater than 90 percent of world CFC production.

hundred thousand additional cases of nonmelanoma skin cancer annually, and, with somewhat less certainty, in several thousand additional cases of melanoma skin cancer (often fatal) annually in the United States alone (ref. 6, p. 6). A relatfonship has been epidemiologically established between increased DUV exposure and incidence of non-melanoma skin cancer (ref. 8). For nonmelanoma skin cancer, approximately a four percent increase in incidence can be expected for every one percent increase in ozone depletion on the average. For melanoma, this statistical relationship is less certain, but appears to be about two to one. (ref. 6, p. 99).

Other significant effects of increased DUV may include reduced crop yields from many important agricultural species, including tomatoes, sugar beets, and corn (ref 6, p. 67); significant larval and juvenile killings of certain seafood species including anchovies, mackerel, shrimp and crab (ref. 6, p. 69); and adverse effects on the microorganisms constituting the base of the marine food chain. These and other environmental effects could be potentially more serious than the effects of ozone depletion upon human health. In addition, continued accumulation of CFCs in the lower atmosphere (troposphere) may induce a slight warning of the mean global surface temperature, but this is less than the warning predicted for a doubling of atmospheric carbon dioxide caused by fossil fuel combustion.

D. Rationale for Including All CFC's

NAS examined only two CFCs, CFC–11 (trichlorofluoromethane) and CFC–12 (dichlorodifluoromethane) because they represent the vast majority of all CFCs produced. NAS also briefly considered CFC–22 (chlorodifluoromethane), but excluded it from the analysis because, as a partially halogenated compound, its likelihood of reaching the stratosphere before dissociating is much less than that of fully halogenated compounds. However, the findings by NAS on the ozone depletion potential of CFC–11 and CFC–12 are relevant qualitatively for all chlorofluorocarbons.

EPA believes that any regulation of ozone depleters should be as comprehensive as possible, consequently this regulation would address all CFCs.

Potential ozone depleters found outside the CFC chemical family may eventually require regulatory action as well. However, the present set of regulations would be limited to CFCs only because there does not exist sufficient information on other ozone depleters, and because the long lifetime in the troposphere of CFCs makes them particularly suspect of increasing the concentration of chlorine in the stratosphere.

The proposed regulatory action would cover chemicals with the following general formula:

$C_nCl_xF_yH_{2n+2-x-y}$; $x>0$, $y>0$

This formula characterizes all alkanes that contain at least one chlorine *and* one fluorine, including CFC–11, CFC–12, CFC–113, CFC–114, CFC–115, and CFC–22, as well as several other CFCs not presently manufactured or manufactured only in very limited quantities. The proposed regulatory action intends to take into account the differing ozone depletion potential of the various CFC compounds. EPA is considering including the bromofluocarbons at a later date if future research substantiates the initial NAS finding that bromine is as effective an ozone depletor as chlorine. (ref. 6, p. 193) EPA solicits comment on this approach to classification of CFCs.

E. CFCs as an International Problem

Ozone depletion truly is a global problem. Regardless of where CFCs actually are emitted, tropospheric mixing results in worldwide CFC distribution with some small differences between the hemispheres caused by the transport from Northern Hemisphere sources to the Southern Hemisphere. Therefore, the danger presented by all CFCs emitted will be spread around the globe. This means that any damage caused by CFC emissions will not be limited within the boundaries of the source country.

The use and production of CFCs are widely distributed around the world, as shown by Table 2.

Table 2.—*World Chlorofluorocarbon Production and Use—1977*

Nation	Percent of total world	
	Use	Production
United States	35.8	39.0
EEC [1]	30.2	39.1
Japan	6.5	7.3
Others [2]	27.5	14.6
Total	100.0	100.0

[1] European Economic Community manufacturers of CFCs are, in decreasing order, Federal Republic of Germany, France, Great Britain, Italy, and The Netherlands.
[2] Other world manufacturers are, in decreasing order, the Communist Bloc, Canada, Australia, Spain, Mexico, Argentina, Brazil, South Africa, India, Israel, Greece, and Venezuela.
Source: EPA analysis of RAND Corporation and CMA data.

As is evident from the above data, no single nation accounts for a large enough portion of world use or production to be able unilaterally to control ozone depletion. If CFC use increases as forecast (about 9% annually), even the United States, which presently represents about one-third of the world market, can have only a small impact in limiting ozone depletion, when acting alone. The limited impact of a unilateral United States reduction (assuming this 9% annual growth) is shown in Table 3.

Table 3.—*Percentage Ozone Depletion Projected Under 3 Growth Scenarios* [1]

Regulatory option (action taken in 1980)	Contribution toward steady-state ozone depletion (in percent)		
	United States	Rest of world	Total
I. No action; uncontrolled growth until 1990	7.5	24.5	32.0
II. Freeze on Production (1980 levels) U.S. only	4.5	24.5	29.0
III. Significant Reductions (70 percent from 1980 levels U.S. only	1.5	24.5	26.0

[1] Assumes that emissions continue indefinitely at 1990 levels.
Source: EPA analysis of Lawrence Livermore Laboratory modelling,

II. Approach to Chlorofluorocarbons Control

A. Choosing a Strategy

To protect health and environment in the United States, EPA both must use its ability to regulate domestic CFC activities and must actively encourage other nations to take similar control actions. Domestic reductions without corresponding international action would be insufficient. Accordingly, the U.S. domestic emissions reduction strategy *must* be chosen not only on the basis of a balancing between risk to the U.S. health and environment (including the relative risk of CFC substitutes), and economic costs, as the law requires, but also on the basis of what effect the choice will have on other nations' decisions in this area. EPA considers that there are three general strategies which it could adopt regarding future emissions.

1. *Wait-and-see*—The United States takes no action until better evidence of the ozone depletion theory is obtained.

This is the least economically burdensome strategy in the short term, since it would avoid the administrative and resource costs imposed by further regulatory control, but it also means that the Agency uses none of its regulatory powers to protect the U.S. health and environment from possible future harm.

It is highly likely that if the United States adopts the "Wait-and-See" strategy, the great majority of other producing and using nations will follow suit. Therefore, a domestic strategy of "Wait-and-See" is likely to be equivalent to a world strategy of "Wait-and-See." This approach of inaction

would most likely result in continuing large growth in the use of CFCs worldwide.

2. *No-Growth*—The United States limits production to present levels (adjusted for ozone depletion potential) and takes no further action until international conditions and further evaluation of the credibility of the ozone depletion theory warrants.

This strategy is more economically burdensome, but it does signal to other CFC-producing and using nations that the United States is concerned enough about the risks entailed in depletion of the ozone layer that it is willing to take serious action on the basis of present knowledge. At the same time, the strategy makes clear that the United States realizes it cannot solve the problem by unilateral action.

3. *Substantial Emissions Reductions*—The United States reduces its production to some fraction of the level predicted to be necessary on a worldwide basis to achieve an acceptably low level of ozone depletion.

This strategy would result in substantial economic costs, but would demonstrate that EPA believes the problem is serious enough to adopt stringent regulatory actions to protect the United States health and environment from possible future harm. However, it is possible that adoption of this strategy could strengthen the "Wait-and-See" attitude abroad by creating the impression that other nations could afford to wait before taking action.

There are two critical problems which make adopting the "Wait-and-See" strategy unacceptable. First, validation of the ozone depletion theory through environmental monitoring is limited because a minimum ozone change of approximately five percent over a period of ten years would be required before a depletion could be observed with statistical confidence. If such measurements were required before regulatory action and, upon availability of these measurements, the nations of the world immediately reduced production, depletion would still continue to increase substantially (an "overshoot") before falling back slowly to more acceptable levels. This overshoot would be primarily be attributed to the CFCs already in the atmosphere. These two factors combined could result in a peak depletion level where unacceptable biological damage would result if action is delayed until ozone depletion is in fact measured.

Second, while it is true that the pursuit of a "Wait-and-See" strategy has no immediate economic cost attached to it, it would make the attainment of a long-term ozone depletion reduction goal much more difficult and costly when and if regulation is eventually undertaken. If world CFC consumption were allowed to grow uncontrolled through 1990, a 65 percent reduction in 1990 use would be required to achieve the equivalent of a 50 percent reduction from present levels. In addition, failure to limit continued CFC growth in the next decade could lead to large capital investments in CFC-dependent technologies. Such investments represent an undesirable allocation of resources if significant reductions are then required in 1990.

The health and environmental problems resulting from adoption of the "no-growth" strategy are essentially the same as those associated with the "wait-and-see" strategy—overshoot possibly leading to unacceptable biological damage, and the higher cost of subsequent actions. If adequate confirmation of the theory is taken to require *measurable* depletion of the ozone layer, the "no-growth" strategy entails precisely the same risks as the "wait-and-see" strategy, except that confirmation would take longer because of reduced annual emissions in the interim. If a decision to act is instead based on cumulative studies of risk coupled with improvements in the modelling of ozone depletion, a "no-growth" strategy would still result in an unacceptable level of risk—assuming such information requires several years. Furthermore, NAS predicts a "no-growth" strategy would result in a four percent level of depletion within a decade.

Consequently, EPA believes that, given the extreme caution which should be exercised because substantial evidence already indicates that the ozone layer is threatened with depletion, the only acceptable long-term strategy is "substantial emissions reductions."

However, if the "substantial emissions reduction" strategy were implemented immediately, this would likely weaken the United States' effort to produce international action of the same magnitude, and virtually nullify the Agency's domestic actions. By comparison, the "no-growth" strategy, while not providing adequate long-term protection, would put the United States in a more moderate position when it presents its case to other nations.

Therefore, EPA considers it advisable to adopt a "no-growth" strategy in the short-term, limiting United States production to present levels, to convince other nations to agree to concerted international action. EPA would consider following this action with a "significant emissions reduction" policy if international conditions warrant, and if there has been no significant diminution in the present credibility or predictions of the ozone depletion theory.

B. Approaches To Implementing a No-Growth Strategy

EPA has identified two major approaches to achieving a production limitation. The Mandatory Controls Approach would control domestic use of CFCs by regulating final product use or production techniques through product bans and technology-based standards. The Economic Incentives Approach would limit domestic use of CFCs by allocating CFC rights among manufacturers or end users. Each of these two major approaches to control is discussed in greater detail below.

1. Mandatory Controls Approach

One way to limit CFC growth is by banning certain uses or by requiring specific control technologies. While a limit on production would not be achieved directly through this strategy, it could be approximated. This approach would be comparable to other regulatory programs administered by EPA under the Clean Air and Clean Water Acts, where EPA has relied primarily on technological controls. EPA could pursue a similar approach to CFC control either instead of or in addition to a direct production limitation. Three options within this approach are discussed briefly below, along with an outline of their advantages and disadvantages. The options could be used either singly or in combination.

Option I: Technology-Based Control

One option is mandatory control technology standards. These standards would be comparable to EPA Clean Water Act effluent limitations: for each CFC-using production process, EPA would identify and mandate the use of the "best available technology" (BAT) or the "best practicable technology" (BPT). Examples of possible mandatory controls include:

1. Recovery and recycle of CFCs from flexible urethane and rigid non-urethane foam production using carbon adsorption techniques;

2. Performance standards on solvent degreasing equipment;

3. Conversion to CFC–502 (a less effective ozone depletor) in retail food store refrigeration;

4. Use of CFC–22 or helium as a test gas in refrigeration equipment manufacture;

5. Recovery and recycle of CFCs during mobile air conditioning servicing and repair.

Each of these possibilities, as well as others not mentioned above, has varying emissions reduction potential. Furthermore, they are in various stages of technical development, and requiring them would have differential economic impacts depending on firm size and other factors. Through efficient development and enforcement of these and similar standards, it is possible that EPA could meet its desired goal.

The problem with technical standards is that growth in the CFC-using industries could, in a manner analogous to that following the aerosol ban, offset any gains made through the implementation of such standards. The CFC-using industries are sufficiently varied and dynamic so that implications of this problem are not insignificant. The simultaneous implementation of more than one of the mandatory control options may mitigate this problem somewhat.

EPA requests comment on the feasibility and cost of these control options, as well as their applicability to the CFC problem.

Option II: Selective Product Bans

EPA could establish criteria through which to weigh the utility of various CFC-using products against their contribution to stratospheric ozone depletion and ban or restrict those products which were determined to have the least social utility compared to risk. By placing outright bans on certain products or uses of CFCs and mandating periodic review of the remaining uses, EPA might be able to achieve its goal of zero growth in ozone depletion potential.

EPA would employ factors such as the following in deciding which products ought to be subject to a ban:

1. The risk to health, safety and the environment, taking into account the type and quantity of CFC used in the product or process;

2. Availability of another product or process which can make the product or provide a similar service;

3. Relative efficiency and effectiveness of substitutes;

4. Essentiality of CFC use in providing a health, safety, or environmental benefit to the American public;

5. The environmental risk posed by substitutes.

Specific product bans have some of the same disadvantages as technology-based standards. Most importantly, growth in other existing uses and the development of new uses could quickly offset any gains achieved by bans. Also, given the absolute nature of a ban, economic efficiency could be lost, since the prohibited uses may be overcontrolled while other exempted uses incur no controls at all—not even those which would be available at low cost.

The above list of factors is not definitive, but it does illustrate the issues that would have to be addressed in making comparisons of utility. EPA requests comment on the appropriateness of specific product bans to address the CFCs problem, and on the factors used to evaluate specific products.

Option III: Use Ceiling Combined With a SNUR

Under this option, EPA would collect use data from individual users of CFCs. A given percentage of historical use would establish a baseline for each user, and any user wishing to exceed its baseline would be required to file a Significant New Use Rule (SNUR) notice. EPA would evaluate all notices received, and prohibit or limit some fraction of them, such that total use in a given year would not exceed the desired levels. Transfers of use rights from one user to another would also require the filing of a SNUR notice. This would allow EPA direct and continuing control over domestic allocation of CFCs. EPA has the authority to implement a SNUR plan under Section 5 of the Toxic Substances Control Act, if the Agency determines it is in the public interest to act under TSCA rather than under the Clean Air Act.

The disadvantages of using a SNUR in this instance are substantial: first, the Agency would have to obtain massive amounts of data through the use of TSCA Section 8 to establish baselines; and second, the filing and evaluation of SNUR notices would absorb substantial amounts of Agency and industry resources.

2. Economic Incentives Approach

An economic incentives approach would function by directly restricting CFC production, causing prices to increase to ration allowed production. As CFC prices rise, firms must decide whether to continue to use CFCs and pay the higher price, or switch to substitute chemicals or processes to reduce CFC consumption. The firm's decision would be a function of the cost and availability of substitutes, the potential for control and the new increased price of CFCs. Those firms for which control is relatively inexpensive would control more extensively. They would have the incentive to continue increasing control until the cost of an additional "unit" of control was equal to the cost of an additional unit of CFC. Alternatively, firms for which control measures are unavailable or exceedingly expensive would take little or no action to control emissions, choosing instead to incur the higher costs of continued CFC use. If the firms involved are generally profit-maximizers, higher prices would provide them the incentive to search for new control options. It is the different control options available to firms and their desire to minimize costs which gives an economic incentive approach its superior efficiency.

EPA is also investigating a use of a tax or surcharge on CFC use to increase the effective price of CFC use. Although this option is less likely to be employed, the Agency welcomes comment on its relative merit.

A production restriction combined with marketable CFC use rights requires a method by which the initial quota would be distributed. There are several ways in which EPA could distribute CFC production or use rights. One is through direct allocation of production permits, either to manufacturers or to users. The other is through an auction system, under which the transfer or "scarcity" payments would flow to the government. The advantages, drawbacks, and specifics of each method are discussed further below.

Option IV. Direct Allocation to Manufacturers

EPA would obtain, possibly under the authority of Section 8(a) of the Toxic Substances Control Act (TSCA) of 1976, specific information on the production of CFCs, as well as on the production or purchase of CFC precursor chemicals, from each of the major domestic manufacturers. Using this information, EPA would establish a production ceiling for the industry based on a particular base year or some formula combining several years. This production ceiling would be measured in "permit pounds," a unit which would allow a producer to vary his mix of products among the various CFCs according to the relative depletion potential of each. (This concept is described in Section II.B.2.a.) Sales of allocations among the manufacturers, or to potential new entrants into the industry, would be permitted.

As described above, the imposition of a production ceiling on CFC manufacturers would induce them to raise the price charged for CFC to allocate the reduced quantity of CFC among users. This increased cost would create an incentive for users to develop CFC conservation techniques or to

switch to substitutes. EPA anticipates that such price increases and the resulting profits to manufacturers would be small initially since the anticipated shortfall in production created by the ceiling would not be large. If the production ceiling were to continue for several years, however, the transfer payments accruing to manufacturers could become quite large. The RAND Corporation estimates that total transfer payments will eventually exceed $2 billion. EPA would consider methods which minimize the windfall to manufacturers and minimize impacts on users.

Option V. Direct Allocation of CFC Permits to Users

Instead of allocating permits to manufacturers as outlined above, EPA could make a direct allocation of CFC permits to user industries. This allocation could be made according to historical use, capacity, or some other measure. While insufficient information on the number and size of firms in user industries would make an equitable allocation extremely difficult to implement, this method of allocation might be the most effective in reducing the volume of explicit transfer payments either to manufacturers or to the government. EPA recognizes that, depending on the market structure and the dynamic interrelationship among using and producing industries, a substantial portion of the transfer payments might ultimately accrue to manufacturers even under a system of allocating permits to users. EPA specifically requests comment on this issue.

Option VI. Government Auction of Permits

Rather than issuing permits *gratis*—and thereby creating the possibility that manufacturers would capture the full volume of transfer payments—an alternative would be for EPA to sell permits to the manufacturers in an auction. This method would allow the government to recoup a large portion of the transfer payments from the manufacturers. This option would be administratively simple, and would be less likely than Option I to freeze the market shares of the manufacturers. Also, a new entrant to the CFC-producing industry would be able to enter the market for permits without the additional cost disadvantage he would encounter if permits were allocated to existing manufacturers rather than auctioned.

Another alternative would be to auction permits to CFC users (those firms which use CFCs in their production processes or as end products). This option would effectively eliminate the producer's share of the transfer payments. In addition, it would maintain the present level of competition among manufacturers, would be administratively simple, and would not significantly deter competition, entry, or exit for either manufacturers or users.

To make matters even simpler administratively, EPA could auction permits in an unrestricted market to manufacturers, users and other potential participants. Users would buy what they could afford to meet their needs. Manufacturers would buy permits to capture some portion of the market, and perhaps to supply CFCs to those users too small to enter the auction or the permit aftermarket. This type of auction would be the easiest to conduct, since monitoring of participation would not be required.

EPA solicits comments on the efficiency and efficacy of the three major incentives-oriented approaches to CFC control outlined above, and especially, comments on possible methods of direct allocation to users or manufacturers; methods of auctioning permit rights; and the impact and incidence of transfer payments.

2.a. The Permit Pound Concept

EPA recognizes that different CFC compounds present varying potential for depletion of stratospheric ozone. Indeed, EPA would structure the production ceiling regulation in such a way as to provide incentives for industry users to shift from those CFCs most harmful to the stratosphere toward those CFCs posing a lesser threat.

EPA would provide this incentive by establishing the production ceiling in terms of "permit pounds". Under this strategy, each type of CFC would be weighted according to its ozone depletion potential relative to the other CFCs. Ozone depletion potential is primarily a function of molecular chlorine content by weight and the lifetime in the atmosphere of the various CFC compounds. Research to date results in the permit pound conversion factors shown in Table 4.

Table 4 compares the ozone depletion potential of other CFCs with that of CFC–11. For example, according to the chlorine content criteria, CFC–115 is only 20% as harmful to the ozone layer as an equivalent weight of CFC–11.

Table 4.—*Depletion Potential Factor*

Type of CFC	(CFC–11 = 1)
CFC–11	1.00
CFC–12	.79
CFC–113	.77
CFC–114	.49
CFC–115	.20
CFC–22	[1].18

[1] CFC–22 cannot be correctly measured strictly according to chlorine content. CFC–22 is partially halogenated, which means that relatively little of the emitted compound ultimately reaches the stratosphere, because of its shorter lifetime.

Source: Lawrence Livermore Laboratory.

2.b. Establishing a Production Ceiling

In setting a production ceiling, EPA would use the permit pound concept in the following manner: production of each CFC in the base year would be multiplied by its respective depletion factor, and the resulting products would be added to yield the allowable ceiling on ozone depletion potential. Under an economic incentives approach, ozone depletion would remain constant, although the use of permit pounds would allow actual poundage to vary. The substitution of less-depleting CFCs allows the overall production level of CFCs to increase without adding to the ozone depletion potential. (See Table 5 and discussion following.)

Table 5.—*Ozone Depletion Equivalents of a Hypothetical Base Year Production*

Type of CFC	Hypothetical base year production (millions of lbs.)	Ozone depletion factor	Ozone depletion equivalent (millions of lbs.)
CFC–11	100	1.00	100
CFC–12	100	.79	79
CFC–113	100	.77	77
CFC–114	100	.49	49
CFC–115	100	.20	20
CFC–22	100	.18	18
Total	600		343

Applying the ozone depletion factors to a hypothetical total base year production of 600 million pounds distributed equally among the major CFCs yields an ozone depletion equivalent of 343 million pounds. This may be considered an "allowable stratospheric chlorine ceiling." Such a ceiling holds potential CFC damage to the stratosphere constant while allowing individual firms to alter their production of individual CFCs within the bounds of the ceiling.

EPA would issue production permits under any of the three options outlined above. Compliance monitoring would consist of a comparison of manufacturers' CFC production records with the amounts of permits that they (a) were allocated under Option I, plus those purchased from other manufacturers; (b) received in

production orders from users, under Option II or III; or (c) directly bought in auction, under Option III, plus purchases from others.

Permits, whether auctioned or allocated directly to users or manufacturers, would be in permit pound units. In the example given above, this allocation is stated in CFC–11 equivalent units. For purposes of determining production mix, firms would be allowed to produce relatively more of those CFCs which have less ozone depletion potential compared with the base compound. The multiplier determining the allowable production equivalent per permit pound is equal to the *inverse* of the ozone depletion factor for each CFC. In short, the less depleting a given CFC, the more would be allowed to be produced per permit pound. For example, the ozone depletion factor for CFC–12 is 0.79 and its inverse is 1.26. Therefore, for each permit pound it is allowed under the production ceiling, a firm could produce 1.26 pounds of CFC–12 compared with only 1.00 pound of CFC–11. The production equivalents derived from Table 4 are shown in Table 6.

Table 6.—*Derivation of Production Equivalents*

Type of CFC	Ozone depletion factor	Production equivalent
CFC–11	1.00	1.00
CFC–12	.79	1.26
CFC–113	.77	1.36
CFC–114	.49	2.04
CFC–115	.20	5.00
CFC–22	.18	5.56

EPA anticipates that the permit pound concept would provide a strong incentive for CFC manufacturers and users, where technically feasible, to seek ways in which to shift their products and processes toward those CFCs with less ozone depletion potential.

EPA requests comments on the permit pound concept, its implementation, and the methods to be used to determine the production ceiling and the production equivalent multipliers.

2. c. Exports Under the Production Ceiling

The global nature of the risks from CFC emission bears heavily on the question of how to treat United States' exports under any regulatory action being considered by EPA. As discussed in Section I.E. above, CFC emissions anywhere around the world contribute equally (depending on the type of CFC and the volume of emissions) to the potential for ozone depletion, which in turn affects all areas of the globe.

Under a production ceiling, EPA's current thinking is that firms could continue to export CFCs in bulk form or in nonaerosol articles, provided that the additional amount would not exceed their quota under the production ceiling. However, it appears unlikely that firms would continue exporting because they would be placed in an unfavorable pricing position in the foreign CFC market. In uses where large amounts of CFCs are contained in the article, such as centrifugal chiller, exporters would probably alter the present practice of shipping the article overseas fully charged with CFCs. Manufacturers might find it advantageous to ship units charged with a test gas, which is then exchanged for the CFC overseas. Such action, however, would depend on the quantity of CFCs contained in the article and the degree to which the increased cost of domestically purchased CFCs could be passed through to the overseas importers.

Under this approach of including exports in the production ceiling, foreign firms could conceivably increase their production to offset any decrease in United States' exports, which would run counter to the long term goal of reducing global CFC emissions. However, some nations have already taken action to limit their capacity to produce CFCs and have indicated that they will consider taking additional actions. EPA, in cooperation with the Department of State and other concerned agencies, will continue to encourage other countries to reduce global releases of CFCs. Furthermore, the alternative, of excluding exports from the production cap and granting exporters additional permits equal to their present level of exports, might have serious international ramifications. The global problem may be exacerbated if the United States is in the position of encouraging other nations to take further actions to control CFC emissions while at the same time not controlling United States' CFC exports.

A theoretical third alternative would be to selectively exclude certain use categories of exports from the production cap and include others, but this would appear to be incompatible with the general philosophy of an economic incentives approach; would be difficult to defend on a use category basis (especially since the desirability of receiving CFCs for certain uses or in certain products would vary among countries); would not solve the problem of bulk shipments of CFCs for unknown uses; and would be difficult to administer.

EPA requests comments on these three alternative approaches to export control, considering business and economic effects, effects on global CFC emissions, international ramifications, and ease of administration. EPA also requests comments on the applicability of Section 12(a)(2) of TSCA to the question of CFC exports. This section empowers the Administrator to control exports if he finds that they would present an unreasonable risk of injury to health or the environment in the United States. Releases from CFCs produced for export will have the same effect on the health and environment of the United States as chemicals produced for domestic use.

2.d. Imports of CFC and CFC-Containing Articles

CFCs are presently imported both in bulk form and in articles. For the production ceiling regulation to be fully efficient, a mechanism must be devised to regulate imports of CFCs and CFC-containing articles so that imports are neither given an advantage nor placed at a disadvantage in comparison to domestic manufacturers. Mechanisms to control imports of these items include: 1. Freezing imports at current levels;

2. Establishing a permit system for imports;

3. Accounting for imports in establishing the production ceiling and including importers in the established allocation system.

The first alternative would operate like a quota system with the allotment equal to the amount of bulk CFCs or CFC-containing articles imported in the base period. CFC imports would be tied to the level of imports for a previous year with both the mix of CFCs and the articles containing CFCs remaining unchanged. This alternative would favor existing importers and virtually prohibit new entrants to the import market. It also would enable importers to enjoy some small profit advantage since they would not be operating under a production ceiling similar to that under which domestic manufacturers of CFCs would be operating. Domestic manufacturers and retailers are not expected to be significantly penalized by this alternative since domestic demand is expected to exceed the supply of CFCs from all sources.

The second alternative would be implemented by establishing a separate ceiling for importers and requiring them to purchase permits equal to the amount of pounds of CFCs they want to import either in bulk form or in articles. Their permit price would likely reflect the domestic permit price. This alternative would remove the possibility of an

unfair competitive advantage accruing to foreign manufacturers due to domestic CFC regulation. It would also permit the sale of permits between firms importing to the United States. Under this alternative, current importers of CFCs should not have any advantage over those attempting to enter the import market. Furthermore, importing firms would be permitted the same flexibility in CFC use and product mix allowed to domestic firms.

The third alternative could be implemented by including imports under the domestic production ceiling and allowing importers to compete in the permit market along with domestic firms. Like the second alternative, this option would allow the transfer of CFC permits and also would remove the possibility of importers enjoying a cost advantage over domestic manufacturers. It woud also allow flexibility in the mix of CFCs originating domestically and abroad, since these two groups would be competing in the same permit market. EPA solicits comments on these options for controlling imports and exports under the proposed production cap.

2.e. Anticipated Technical Responses to an Economic Incentives Approach to a Production Ceiling

EPA has undertaken research to attempt to predict the measures that CFC-consuming industries might take to stay within the production ceiling. The RAND Corporation has identified a number of steps that industry may take to reduce CFC consumption. These steps do not necessarily exhaust the options for recovery and recycle or substitutions that may be available in the future. Indeed, EPA expects that additional options will become available to industry as research and innovative techniques are stimulated by higher CFC prices.

Initial Actions

a. Large molded foam plants would install recycle and recovery systems;

b. CFC–12 would be replaced by CFC–502 in the manufacture, installation, and servicing of medium temperature refrigeration systems, and by CFC–22 in leak testing in the servicing of retail food refrigeration systems;

c. Solvent cleaning and drying units would either conserve through recycling or find substitutes, and some units would by modified to reduce losses;

d. Flexible slabstock foam plants would convert to methylene chloride.

Intermediate Actions

a. Polystyrene sheet plants would install recycle and recovery systems;

b. All solvent cleaning and drying units would further substitute other solvents, and medium-sized units would also recycle more intensively;

c. Molded foam plants and flexible slabstock plants would install recycle and recovery systems where CFC–11 was still used.

Later Actions

a. All flexible foam plants would improve their collection efficiencies;

b. Polystyrene sheet plants would convert to pentane blowing agent;

c. All solvent cleaning and drying units would further substitute other solvents, and large units would increase their recycling efforts.

These three sets of actions are aniticipated to produce the following reductions (from projected levels) in CFC use from 1981 to 1983. (Reductions are given in both real and permit pounds).

Table 8.—*Reductions From Uncontrolled Growth*

[In millions of pounds]

Phase	1981		1982		1983	
	Real pounds	Permit pounds	Real pounds	Permit pounds	Real pounds	Permit pounds
Initial action:						
a	13.2	13.2	13.9	13.9	14.5	14.5
b	0.0	3.6	0.0	3.8	0.0	4.0
c	20.7	15.9	21.3	16.4	22.0	16.9
d	15.0	15.0	15.8	15.8	16.5	16.5
Total	48.8	47.7	51.0	49.9	53.0	51.9
Intermediate action:						
a	7.6	6.0	8.0	6.4	8.4	6.7
b	4.9	3.8	5.2	4.0	5.6	4.3
c	6.0	5.2	6.3	5.4	5.6	5.7
Total	18.5	15.0	19.5	15.8	20.6	16.7
Later action:						
a	6.5	6.5	6.8	6.8	7.2	7.2
b	7.6	6.0	8.0	6.4	8.4	6.7
c	13.6	10.5	14.6	11.2	15.5	11.9
Total	27.4	23.0	27.4	24.4	31.1	25.8
Grand total	90.0	81.8	95.1	86.4	100.3	91.1

NOTE.—Figures may not sum due to rounding.

Source: Rand Corporation.

III. A Summary of Issues on Which Comments Are Requested

EPA welcomes general comment on all aspects of chlorofluorocarbon regulations, from members of industry and the general public. EPA especially solicits comment on the following issues:

1. Scientific validity of the ozone depletion theory. Comments on the two 1979 reports of the National Academy of Sciences, and the NASA Report 1049, December 1979.

2. Risks of continued world chloroflurocarbon emissions. Comments on how these risks, both to human health and the environment, should be quantified and evaluated.

3. Strategies for level of CFC control. Comments on the validity of a Production Ceiling Strategy, as contrasted with Wait-and-See, and Substantial Emissions Reduction.

4. International aspects of CFC regulatory effort. Comments on how to inprove the level of international cooperation on this issue and issues related to the import and export of CFCs.

5. Approaches to achieving a production ceiling domestically: comments on economic incentives approaches to chemical regulation; desirability of the avarious auction and allocation methods; the permit pound concept; and methods of directly allocating quotas or permits to manufacturers or to users. Comments also on the mandatory controls approach to CFC regulation, including production bans, technology based standards, and SNURs.

Douglas Costle,

Administrator.

September 30, 1980.

References

1. 43 *Federal Register* 11502.

2. RAND Corporation, *Economic Implications of Regulating*

Chlorofluorocarbon Emissions from Nonpropellant Applications, (Santa Monica, CA, June 1980).

3. Department of Transportation, *Upper Atmospheric Programs Bulletin*, No. 79–5 (October 1979, Washington, DC).

4. National Academy of Sciences, *Halocarbons: Effects on Stratospheric Ozone*, (September 1976, Washington, D.C.).

5. NAS, *Stratospheric Ozone Depletion by Halocarbons: Chemistry and Transport*, (November 1978, Washington, D.C.)

6. NAS, *Protection Against Depletion of Stratospheric Ozone by Chlorofluorocarbons*, (December 1979, Washington, D.C.)

7. National Aeronautics and Space Administration, RP–1049 (December, 1979, Washington, D.C.), *"The Stratosphere: Present and Future"*.

8. National Cancer Institute, *Incidence of Nonmelanoma Skin Cancer in the United States, 1977–78*, April, 1980.

[FR Doc. 80–31165 Filed 10–6–80; 8:45 am]

BILLING CODE 6560–01–M